

***Keraudrenia exastia* and *Keraudrenia katatona* (Malvaceae:
Byttnerioideae), new species from the Kimberley region
of Western Australia**

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Abstract

Wilkins, C.F. *Keraudrenia exastia* and *Keraudrenia katatona* (Malvaceae: Byttnerioideae), new species from the Kimberley region of Western Australia. *Nuytsia* 13(1): 233–242(1999). *Keraudrenia exastia* C.F. Wilkins and *K. katatona* C.F. Wilkins are two new species endemic to the Kimberley region of Western Australia. They are described and illustrated, and their distributions are mapped. *K. exastia* is considered to be critically endangered, due to its restricted distribution in Dampier Peninsula where its survival is threatened by industrial expansion. A chromosome number for *K. exastia* of $n=10$ is presented as the first published count for the genus and a key is provided for distinguishing the three species of *Keraudrenia* in the Kimberley region.

Introduction

Keraudrenia Gay belongs to subfamily Byttnerioideae (*sensu* Bayer *et al.* 1999) of the broadly circumscribed Malvaceae (including Sterculiaceae, Bombacaceae and Tiliaceae) *sensu* Judd & Manchester (1997) and accepted by The Angiosperm Phylogeny Group (1998). It is an endemic Australian genus that has not been revised since Bentham's (1863) treatment in "Flora Australiensis". Eleven species of *Keraudrenia* were recognized in a recent census of Australian plants (Hnatiuk 1990). There are also some unnamed species including two that were referred to as species A and B in a book of plants from the Broome area of the Kimberley region, Western Australia (Kenneally *et al.* 1996).

In preparation for a treatment in "Flora of Australia", a cladistic analysis and taxonomic revision of the genus are in progress. As one of the unnamed Kimberley species appears to be endangered, it is described here before the revision is completed. The opportunity is taken to address other problems involving the Kimberley taxa, including naming a second new species which was treated as *K. velutina* Steetz in "Flora of the Kimberley Region" (Wilson 1992). This paper also provides a key to the three species now recognized in the Kimberley region.

Keraudrenia sp. A "Flora of the Kimberley Region" (T.E.H. Aplin *et al.* 333) is known from three small populations in the Dampier Peninsula, Gordon Downs Station and Wolf Creek in the Kimberley region and also near Soudan and Mt Isa in Queensland. It differs from typical *K. nephrosperma* in having carpels that are almost glabrous laterally, with a dorsal ridge of stellate hairs. In the current

revision, sp. A has been combined with *K. nephrosperma* as the amount of stellate indumentum on the sides of the carpels is variable between populations and not considered positively indicative of a distinct taxon.

The presence of twisted styles was used as a key distinguishing feature of *Keraudrenia velutina* (Wilson 1992), however, twisting of styles is initially present in all species of *Keraudrenia*. The styles later become separate and straight.

Methods

Taxon status. Morphological characters of *K. exastia*, *K. katatona* and closely related species of *Keraudrenia* were examined from fresh material and rehydrated material from herbarium specimens. These included type specimens and were obtained from the following herbaria: AD, BM, BRI, CANB, DNA, HO, K, MEL, NSW, P, PERTH and W. Characters were scored and entered into a MacClade 3.05 database as part of research into phylogeny of the genera of tribe Lasiopetaleae (Wilkins & Chappill in prep.).

Measurement of characters. Hair density was quantified as follows: sparse refers to hairs well spaced; medium density refers to hairs just touching laterally; dense refers to hairs overlapping laterally, with the epidermis still visible; tomentum or tomentose refers to hairs overlapping to the extent that the epidermis is no longer visible.

Calyx tube length was measured from the centre of the flower to the junction of the lobes.

Chromosome count. Fresh anthers from field collections were fixed in 4: 3: 1 chloroform: absolute ethanol: glacial acetic acid for 24 hours, rinsed in 70% ethanol and stained in alcoholic hydrochloric acid carmine for 2–10 days. Meiosis was examined in pollen mother cells of anthers squashed in 45% glacial acetic acid. Chromosomes were micrographed x100 using a Zeiss Axiophot microscope and 6 ASA Imagelink film.

Taxonomy

Key to *Keraudrenia* in the Kimberley region

1. Calyx lobes broadly ovate, broader than long, apex rounded or sub-acute, margin entire, mature calyx lobe venation thickened-reticulate, veins on inner surface not prominent. 9–17 flowers per inflorescence. Stamen filament fused to ventral surface of anther. Carpels free or fused laterally
2. Carpels free. Staminodes to 1 mm long, generally with erect apex. (Dampier Peninsula to Gordon Downs Station, also NT, SA, NSW and Qld) ***K. nephrosperma***
2. Carpels free centrally, but fused laterally at base. Staminodes 1–2 mm long, apex often recurved or with sterile anthers or swollen apex. (Broome, Edgar Range and NE of Port Hedland) ***K. katatona***

1. Calyx lobes ovate, longer than or as long as broad, apex acuminate, margin roughly fringed, mature calyx lobe venation not obviously reticulate, fresh flowers with mid and lateral veins prominent on inner surface, only mid vein prominent on dried flowers. 7–9 flowers per inflorescence. Stamen filament not fused to ventral surface of anther. Carpels free centrally, but fused laterally at base. (Broome) **K. exastia**

Keraudrenia exastia C.F. Wilkins, *sp. nov.*

Species insignis costa et venis lateralibus calyce tumidis, margo calyce apicali valde fimbriato ut acuminato, lobis longioribus quam latioribus, speciebus mihi notis bene distincta.

Typus: Dampier Peninsula, West Kimberley [precise locality withheld], Western Australia, 25 May 1995, C.F. Wilkins CW 828, K. Shepherd, R. Orifici, P. Foulkes & T. Willing (*holo:* PERTH 05232031; *iso:* CANB, MEL, K).

Shrub, erect, compact, multistemmed, 70–90 cm high, asexual reproduction by rhizomes not investigated. *Stems* terete; apical branchlets with a tomentum of pale tan and white stellate hairs to 0.2 mm diameter (c. 24 cells per hair). *Stipules* narrowly ovate or ovate, 1.5–4 x 0.3–0.5 mm; adaxial surface with medium density, stellate hairs and scattered, stipitate, clavate glands c. 0.1 mm long, abaxial surface with stellate-tomentum. *Leaves* alternate, spreading; petiole 3–6 mm long; base obtuse, blade flat or conduplicate, narrowly ovate, elliptic or oblong, (6)15–20 (28) x 5–10 mm, margin entire; both surfaces with a pale grey-green tomentum of stellate hairs; abaxial surface with prominent veins and occasional, red, stipitate, capitate glands c. 0.25 mm in diameter; apex obtuse, rarely retuse; young growth leaves not observed. *Inflorescence* a dichasial cyme, 7–9-flowered, 15–22 mm long, flowers 5- rarely 4-merous. *Peduncle* 2–3 mm long, stellate-tomentose. *Pedicel* 4–7 mm long, faintly articulate, stellate-tomentose. *Bract* caducous, purple, petaloid, attached on pedicel below articulation, elliptic, 3.5–9.5 x 0.5–4 mm, margin fringed; adaxial surface with scattered, fine, white, stellate indumentum; abaxial surface with dense, pale-tan-centred stellate hairs; apex apiculate. *Calyx* purple, petaloid, with base of inner rib a yellow-green, tube and lobes initially deflexed from staminal tube, ovate, 9–12 mm long, longer than wide, lobes comprise 65–80% of calyx length; adaxial surface of lobe with prominent midrib and lateral veins prominent when fresh, margin of adaxial surface with few simple hairs, tube and centre of lobe with stipitate, white, clavate glands, 0.15 mm long, rarely stellate hairs at base; abaxial surface of calyx with medium density, stellate hairs, 0.2–1.0 mm diameter, denser at the base of the calyx, capitate glands absent; margin minutely denticulate with apical stellate hairs on the teeth; lobe apex acuminate; fruiting calyx not observed. *Corolla* usually absent (one petal observed on one flower, obovate, c. 1.0 x 1.2 mm, outer surface stellate-hairy). *Stamens* shortly fused at the base; *staminal tube* c. 0.8 mm long; *staminodes* narrowly triangular, yellow, c. 1.3 x 0.15 mm, frequently with recurved apex and rarely with minute sterile anther affixed; *filaments* yellow, c. 0.15 mm long; *anthers* extrorse, ventrifixed, curved, 1–1.3 x 0.6–0.7 mm, yellow when young, becoming faded purple with age, stellate hairs rarely present on anther margins, pollen yellow. *Ovary* c. 1 x 1 mm, 5-celled rarely 4-celled, carpels free centrally, fused laterally at lower centre, ovary outer surface with papillae, developing post anthesis into stellate hairy setae (bristles with stellate hairs along length and apex); ovules 5 or 6 per cell. *Styles* 5(4), 3.3–4 mm long, glabrous. *Stigma* simple. *Fruit* not observed. (Figure 1)

Chromosome number. n=10. (Figure 2)

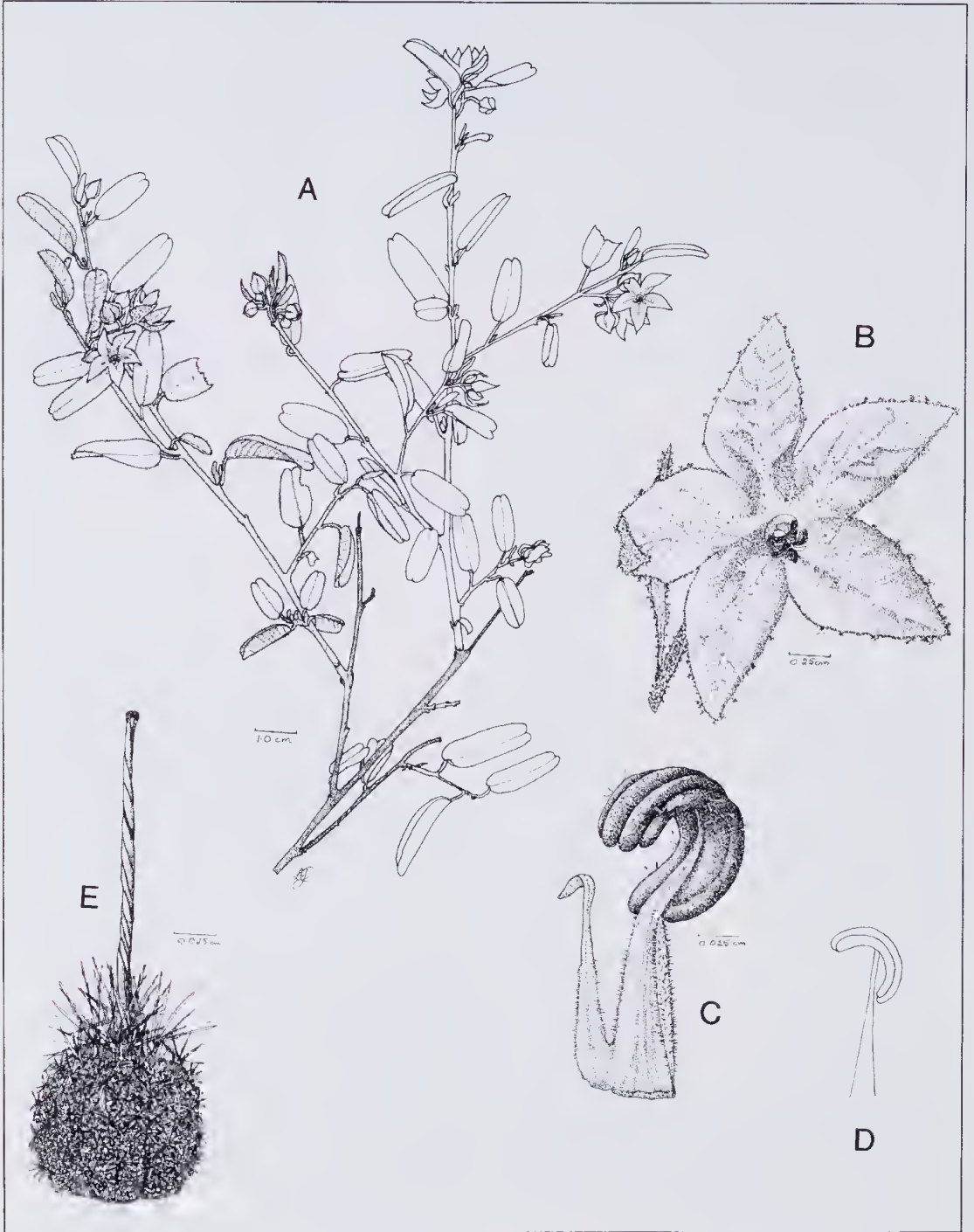


Figure 1. *Keraudrenia exastia* A – habit, B – flower, C – stamen and staminode, D – ventrifixed anther, E – gynoecium.

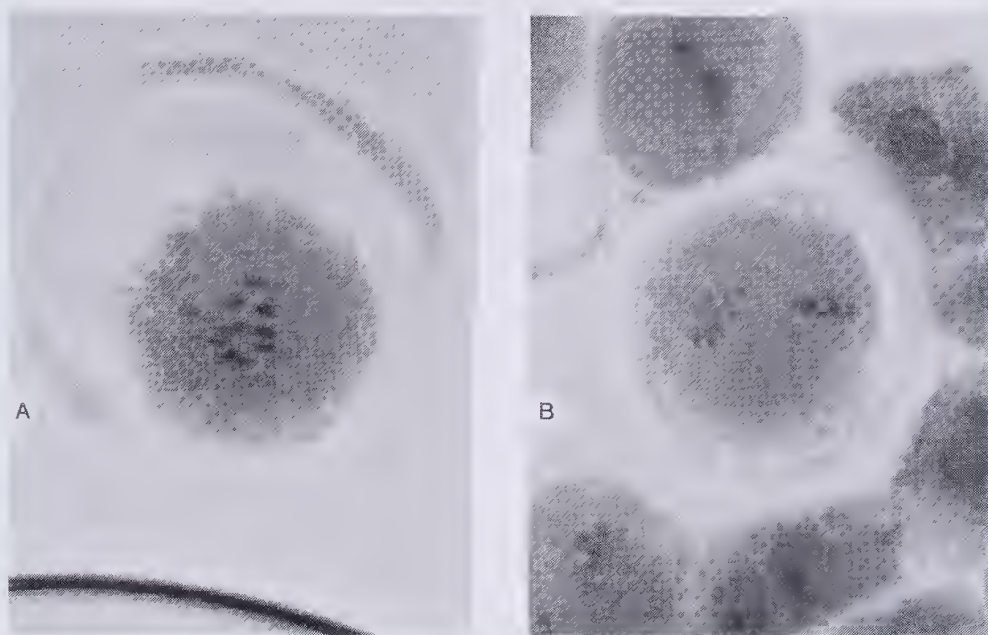


Figure 2. Meiosis in *Keraudrenia exastia* (voucher C.F. Wilkins CW 825), n=10; A – first metaphase; B – second metaphase.

Selected specimens examined. WESTERN AUSTRALIA: Broome, Dampier Peninsula, 2 Nov. 1991, B.J. Carter 501 (PERTH); E of wharf, Broome townsite, Dampier Peninsula, 13 Aug. 1985, K.F. Kenneally 9429 (PERTH); Broome, Dampier Peninsula, 29 Apr. 1987, K.F. Kenneally 9866 (PERTH); WNW of Broome, 22 Aug. 1993, A.A. Mitchell 3282 (PERTH); Broome, Dampier Peninsula, 25 May 1995, C.F. Wilkins CW 825–829, K.A. Shepherd, R. Orifici, P. Foulkes & T. Willing (CANB, K, MEL, PERTH, UWA); Broome, Dampier Peninsula, 25 May 1995, C.F. Wilkins CW 831–837, K.A. Shepherd & R. Orifici (PERTH, UWA).

Distribution. Restricted to coastal populations on the Dampier Peninsula, near Broome Western Australia. (Figure 3)

Habitat. This species occurs in relict desert dune swale in red sand (pindan), in *Acacia* shrubland (to 3 m) with *Gyrostemon*, *Triodia*, *Hakea* and *Eucalyptus*. One population occurs down the slope from an area of deciduous vine thicket.

Phenology. Flowering period April to December. Fruit not observed (P. Foulkes †, K. Kenneally & T. Willing, pers. comm.).

Conservation status. This species currently has CALM Conservation Codes for Western Australia Flora: Priority One. However, it has been proposed as declared rare-extant with conservation status of Critically Endangered. Only seven populations are known in close proximity on Dampier Peninsula and are under threat from encroachment by the port industrial area. This species has been recognized for some time and occurs in an area of diverse coastal pindan, which, given the rarity of this plant, should be given some protection.

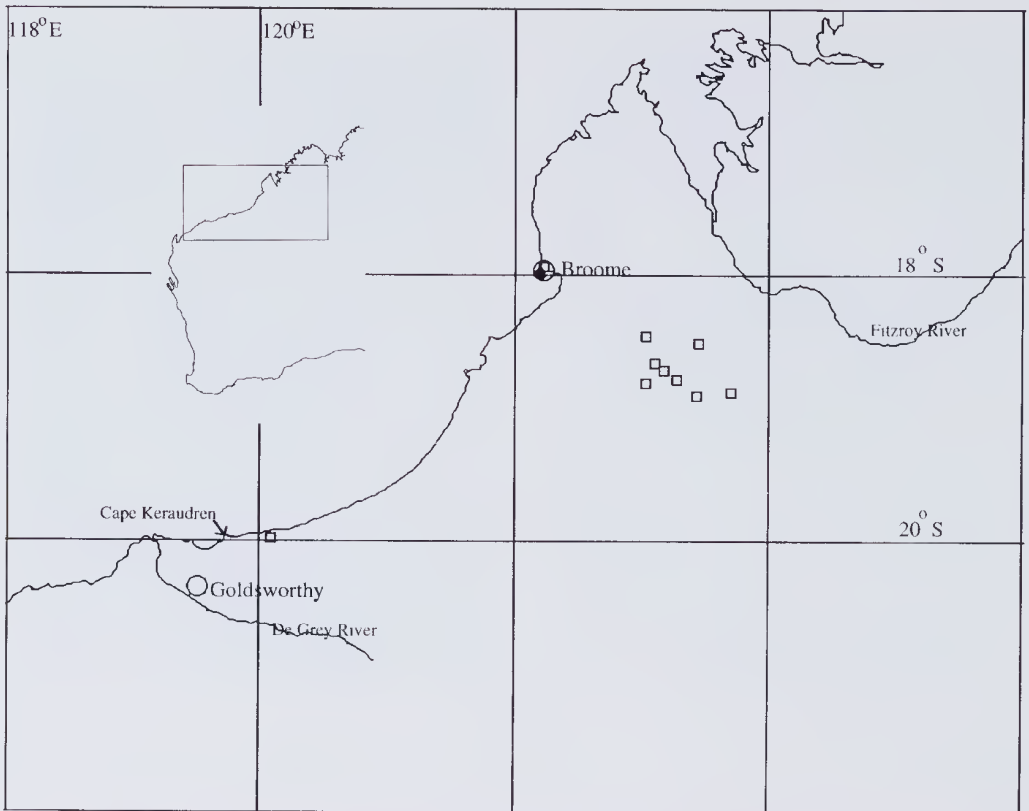


Figure 3. Distribution of *Keraudrenia exastia* ● and *K. katatona* □, West Kimberley region of Western Australia.

No fruit has been observed in our field collection or by other researchers over the past ten years. Closely related species of *Keraudrenia* have vegetative propagation from rhizomes and investigation of this form of reproduction in *K. exastia* is suggested.

Etymology. The specific epithet – *exastia* is from the Greek – *exastis* meaning rough edge or fringe (Brown 1956), in reference to the strongly fringed margin of the mature calyx and bract.

Affinities. The grey, tomentose, entire, elliptic or oblong leaves and purple calyx lobes with acute apices suggest this species is closest to *K. velutina* Steetz. subsp. *elliptica* C.F. Wilkins ms. *K. exastia* differs in having shorter mature pedicels (4–7(9) mm long compared with 5–15 mm); anthers that remain curved after dehiscence rather than becoming straight; anthers that are separate rather than laterally adherent to form a tube, and are ventrifixed not ventri-adnate (filament fused to anther ventral surface); and inflorescences that tend to have fewer (7–9, not 6–13) flowers. Fresh material of the *K. exastia* calyx has swollen lateral veins, not just a swollen mid rib, the apex of each calyx lobe is acuminate and the apical margin is strongly fringed rather than acute and entire. Calyx lobes also differ in being longer than wide, rather than slightly wider than long or nearly the same width as length. *K. velutina* subsp. *elliptica* ms. has not been collected in the Kimberley area but is widely distributed in Western Australia from Nanutarra and Karajini National Park to north of Paynes Find and in the south-west of the Northern Territory and the north-west of South Australia.

Notes. In “Flora of the Kimberley Region” Wilson (1992) refers to this species in a note following *K. velutina*. It is reported as having collections from the Broome area with almost concolorous grey leaves that may be referable to *K. velutina* but not appearing to set fruit and therefore difficult to identify.

The purple recurved calyx and yellow stamens give the flowers of *K. exastia* a superficial resemblance to *Solanum* species, however, the calyx in *Solanum* is green beneath the purple recurved petals.

Keraudrenia katatona C.F. Wilkins, *sp. nov.*

[*Keraudrenia velutina* auct. non Steetz Wilson (1992:191).]

Keraudrenia nephropermo F. Muell. affine sed carpellis ad centrum libris, ad basim lateraliter conjunctis; staminodiis 1–2 mm longis subulatis saepe ad apicem recurvis, interdum antheris parvis sterilibus praeditis differt.

Typus: 300 metres south of south boundary of “Airport, One Mile Aboriginal Community”, Broome, Western Australia, 17° 56' 37"S, 122° 14' 09"E, 24th May 1995, C.F. Wilkins CW 807, K.A. Shepherd, R. Orifici, T. Willing, P. Foulkes, J. Martin & D. Duncan (*holo*: PERTH 05232058; *iso*: CANB, MEL, K, BRI).

Shrub, erect, compact, multistemmed, to 1 m high, with asexual reproduction by rhizomes. *Stems* terete; apical branchlets tan tomentose, with stellate hairs to *c.* 0.4 mm diameter, (*c.* 24 cells per hair). *Stipules* narrowly ovate, 2–4.5 x 0.6–1 mm; adaxial surface with scattered, clavate, glands *c.* 0.1 mm long; abaxial surface tomentose with tan-centred, white, stellate hairs. *Leaves* alternate, spreading; petiole 2.5–6 mm long (young growth plants *c.* 8 mm), stellate-tomentose; blade flat, base obtuse, young growth leaves trilobed then ovate, *c.* 35 x 18 mm, becoming oblong-elliptic, 12–28 x 6–10 mm; adaxial surface with whitish-green stellate tomentum or dense stellate hairs; abaxial surface with prominent veins, and a tan or whitish-green tomentum with occasional, stalked, capitate, red glands *c.* 0.25 mm diameter; margin entire; apex obtuse or retuse. *Inflorescence* a dichasial cyme, 9–17 flowered, 20–30 mm long, flowers 3–5-merous. *Peduncle* 3–7 mm long, stellate-tomentose. *Pedicel* 7–11 mm long, articulate, stellate-tomentose. *Bracts* caducous, purple, petaloid, attached on pedicel below articulation; broadly ovate or elliptic, 3.5–6 x 1–2.5 mm; adaxial surface with scattered to medium density, fine, white, stellate hair; abaxial surface with medium density, tan-centred, stellate hair; margin fringed; apex acute. *Calyx* purple, petaloid, with inner rib-base yellow-green, tube and lobes initially deflexed, broadly-ovate, 7–9(10) mm long, same width as length or wider than long, tube 50% of calyx length; lobe adaxial surface margin and apex with few simple hairs, tube and centre of lobe with midrib prominent and scattered, stalked, clavate, white glands *c.* 0.15 mm long; abaxial surface of calyx with medium density stellate hairs, a mix of 0.2–1 mm diameter stellate hairs, denser at base of calyx with occasional, stalked, capitate, red glands; fruiting calyx with reticulate venation; lobe margin entire; lobe apex rounded or sub-acute. *Corolla* absent. *Stamens* shortly fused at base; *staminal tube* *c.* 0.5 mm long; *staminodes* subulate, yellow, *c.* 1–2 x 0.2 mm, apex usually recurved, often thickened or with minute sterile anthers affixed; *filaments* yellow, 1.5–1.8 x 0.4 mm; *anthers* extrorse, ventri-adnate (apex of filament fused to ventral surface of anther), curved, *c.* 1 x 0.5–0.7 mm, blackish purple, glabrous, pollen orange. *Ovary* *c.* 1 x 1 mm, 3–5 celled, carpels free centrally, fused laterally near base, ovary outer surface with papillae, which post anthesis develop into setae; ovules 3 or 4 per cell. *Styles* 3–5, 1.5–3.2 mm long, glabrous. *Stigma* sub-capitate while receptive. *Fruit* 4–5 x 5–6 mm, outer surface with setae to *c.* 1.5 mm long (only immature fruit seen). *Seed* reniform (only immature seed seen). (Figure 4)

Selected specimens examined. WESTERN AUSTRALIA: Mangel Creek to Mowla Bluff Road, 7 km N of Dampier Downs turn-off, 16 June 1976, A.C. Beauglehole ACB53079 (PERTH); R1. Edgar Range Site, Edgar Range, SE of Broome, 6 Aug. 1976, K.F. Kenneally 5479 (CANB, PERTH); R2. Red Dune

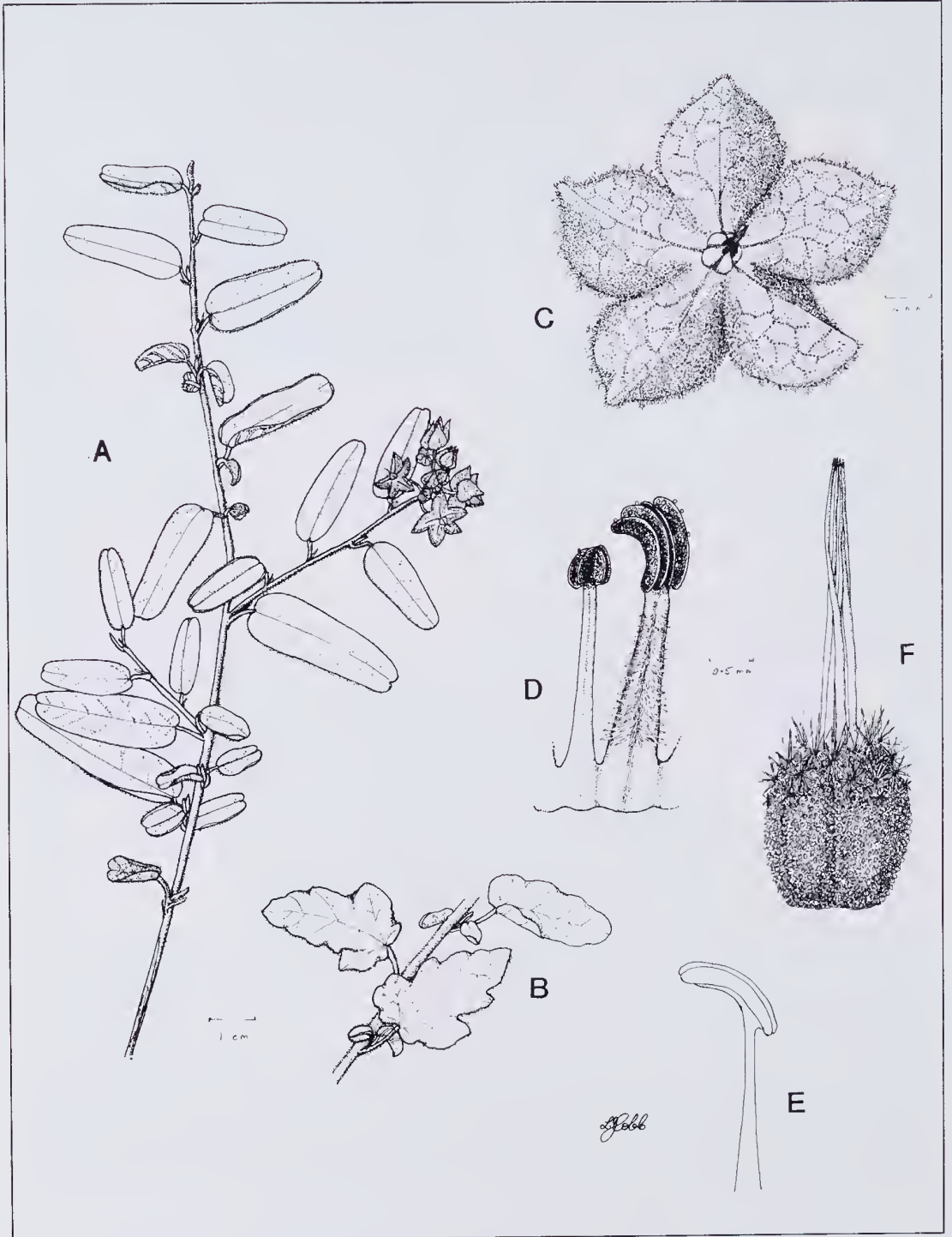


Figure 4. *Keraudrenia katatona* A - habit, B - juvenile leaves, C - flower, D - stamen & staminode, E - ventri-adnate anther, F - gynoecium.

Site, near Edgar Range, SE of Broome, 8 Aug. 1976, *K.F. Kenneally* 5514 (CANB, PERTH); D1. Red Dune Site, near Edgar Range, SE of Broome, 13 Aug. 1976, *K.F. Kenneally* 5636 (CANB); P1. Near Edgar Range, SE of Broome, 18 Aug. 1976, *K.F. Kenneally* 5749 (PERTH); 300 metres S of S boundary of Airport 'One mile Aboriginal Community, Broome, *C.F. Wilkins* CW 799–810, *K.A. Shepherd*, *R. Orifici*, *P. Foulkes*, *T. Willing*, *J. Martin* & *D. Duncan* (PERTH, UWA); 187.4 km NE of Port Hedland on Great Northern Highway, *C.F. Wilkins* CW 83 (PERTH, UWA); SE of Broome, Dampier Downs Station, track from McLeods well to Edgar Range south gorges, 24 May 1995, *C.F. Wilkins* CW 860–865 (PERTH, UWA).

Distribution. Restricted in distribution to Broome, the Edgar Range (SE of Broome) and north-east of Port Hedland in Western Australia. (Figure 3)

Habitat. Red sand, desert dunes in pindan with *Acacia*, *Triodia* and *Eucalyptus* open shrubland to 3 m high.

Phenology. Flowering period March to August.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Three. *K. katatona* is known from a population in a disturbed fire-break area near Broome, several large populations in the Edgar Range within Dampier Downs Station and one road verge plant, north-east of Port Hedland.

Etymology. Derivation of the specific epithet, is from the Greek word – *katatonus* meaning “broader than high” (Brown 1956) in reference to the broader than long calyx lobes of this species.

Affinities. *K. katatona* is similar to *K. nephrosperma* in having tan, tomentose apical branchlets, fruiting calyces with obvious, reticulate venation and broadly ovate lobes that are generally broader than long. It differs, however, in having carpels with some lateral fusion as found in *K. exastia*, instead of distinct carpels as found in *K. nephrosperma*. In the Kimberley, *K. katatona* also differs from *K. nephrosperma* in having staminodes that are 1–2 mm long, subulate, often with recurved apices and occasionally with small, barren anthers, rather than shorter, 0.7–1 mm long, non-recurved, staminodes. The calyx lobe apex is sometimes sub-acute and less rounded than in *K. nephrosperma*.

Notes. *K. katatona* was included in the “Flora of the Kimberley Region” as *K. velutina* Steetz. It differs from the typical *K. velutina* in having calyx lobes that are broader than long with sub-acute apices, rather than longer than broad with acute apices, and also in having mature leaves that are more elliptic-oblong (L:W 2:1) than linear-oblong (L:W 3:1) in shape, with less ferruginous hairs on the lower surface.

Acknowledgements

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References

- The Angiosperm Phylogeny Group. (1998). An ordinal classification for the families of flowering plants. *Annals of the Missouri Botanical Garden* 85: 531–553.
- Bayer, C., Fay, M.F., de Bruijn, A.Y., Savolainen, V., Morton, C.M., Kubitzki, K., Alverson, W.T., Chase, M.W. (1999). Support for an expanded family concept of Malvaceae within a recircumscribed order Malvales: a combined analysis of plastid *atpB* and *rbcl* DNA sequences. *Botanical Journal of the Linnean Society* 129: 267–295.
- Bentham, G. (1863). "Flora Australiensis." Vol.1 (Lovell Reeve & Co.: London.)
- Brown, R.W. (1956). "Composition of Scientific Words." (Smithsonian Institution Press, Washington DC.)
- Hnatiuk, R.J. (1990). "Census of Australian Vascular Plants." (Australian Government Publishing Service: Canberra.)
- Judd, W.S. & Manchester, S.R. (1997). Circumscription of Malvales as determined by a preliminary cladistic analysis of morphological, anatomical, palynological, and chemical characters. *Brittonia* 49: 384–405.
- Kenneally, K., Edinger, D. & Willing, T. (1996). "Broome and Beyond." (Dept CALM: Western Australia.)
- Wilson, A.J.G. (1992). Sterculiaceae. In: Wheeler, J.R. (ed.), Ryc, B.L., Koch, B.L. & Wilson, A.J.G. "Flora of the Kimberley Region". pp. 191–192. (Dept CALM: Western Australia.)